of the intermediate products may exist in such small quantities as to escape detection.—WILLIAM CROCKER.

Endogone.—A paper by BUCHOLTZ[12] on the subterranean genus *Endogone* presents an unusually important addition to our knowledge of the group Hemiasci, established by BREFELD to include supposed transitional forms between the Phycomycetes and Ascomycetes. Further study of the forms which were originally placed in the Hemiasci has resulted in the gradual dismemberment of that group until it has lost its taxonomic status. As a result of the work of BUCHOLTZ on *Endogone*, that form also must be removed from the Hemiasci and classed with the Phycomycetes. BUCHOLTZ includes in his account 7 of the 17 species of *Endogone* (including one described as new in his paper). Two of these, *E. lactiflua* Berk. and *E. Ludwigii* Bucholtz, have a sexual process resembling that of the Phycomycetes; *E. macrocarpa* Tul. and *E. microcarpa* Tul. produce only chlamydospores; in *E. pisiformis* Link. the zygospores or chlamydospores of the other forms are represented by sporangia whose contents break up into spores as in the mucors; and in the remaining forms studied, *E. lignicola* Pat. and *E. fulva* (Berk.), the mode of reproduction is not definite. In these either sporangia or thin-walled chlamydospores are produced.

The youngest fruit bodies of *Endogone lactiflua* examined consist of a tissue of interwoven hyphae covered by an outer more firmly interwoven layer, forming a sort of peridium. Foreign hyphae occasionally penetrate the fruit body, but these are easily distinguished from hyphae of *Endogone* by their straight course and parallel walls. The hyphae of *Endogone* are sinuous in their course and have many irregular inflations. Male and female gametangia arise as saclike outgrowths of the hyphae. The nuclei in the gametangia are arranged peripherally and undergo one division. There is no differentiation of the protoplasm into periplasm and ooplasm as in the Peronosporales. A large nucleus, whose origin is not clear, appears in the center of the gametangium. The other nuclei pass toward the base of the gametangium, which is then cut off from the upper uninucleate portion by a wall. The process is the same in both gametangia. The fusion of the uninucleate gametes begins at the time of the formation of the wall. The nucleus of one gamete passes into the other gamete, but no fusion of nuclei takes place. At the apex of the fusion cell, now containing both nuclei, a portion of the wall is gelatinized, and at this point a papillate outgrowth appears, which gradually enlarges as the protoplasm and nuclei pass into it from the fusion cell. This outgrowth

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[12] BUCHOLTZ, F., Beiträge zur Kenntnis der Gattung *Endogone* Link. Beih. Bot. Centralbl. **29**:147–225. *pls. 8.* 1912. Originally published in Russian: Neue Beitr. zur Morph. und Cytologie der unterirdischen Pilze. T. I. Die Gattung *Endogone* aus d. Nat.-Hist. Museum d. Gräfin K. Scheremetjeff in Michailowskoje. Moskau **9**:1911. See also preliminary note: Über die Befruchtung von *Endogone lactiflua* Berk. Ann. Myc. **9**:329–330. 1911.

enlarges and forms the zygote or zygospore. The zygospore becomes surrounded by a thick wall showing differentiation into several layers. In its completed state it is inclosed in a network of hyphae whose walls fuse and become greatly thickened, forming, in cross-section, a sort of a corona around the zygospore. The nuclei were not observed to fuse in the zygospore of this species, but in *Endogone Ludwigii* a single large nucleus, supposed to be a fusion nucleus, was observed in some of the zygospores. This process of zygospore formation was observed only in the two species mentioned. In the other species the fruit body is filled with asexually formed chlamydospores or with sporangia in place of zygospores.

In his discussion the author points out the close resemblance between the sexual reproduction of *Endogone* and the mucors on the one hand, and on the other hand certain homologies between *Endogone* and the Ascomycetes. Thus in the peculiar outgrowth of the fusion cell and the paired nuclei, he sees a homologue of the ascogenous hyphae of the Ascomycetes, in some of which (as CLAUSSEN has shown for *Pyronema confluens*) the male and female nuclei do not fuse, but remain in pairs until the formation of the ascus.—H. HASSELBRING.

Position of Gnetales.—In 1911 LIGNIER and TISON published a brief statement of their view that Gnetales are apetalous angiosperms, a statement that was noted and commented upon in this journal.[13] Now they have begun the publication of an extended argument for their position, the first part dealing with *Welwitschia*.[14] A very full résumé of the literature prepares the way for a consideration of all the kinds of testimony available. The conclusions reached cannot be attacked on the basis of insufficient knowledge of the facts at hand, but of course they rest upon personal judgment as to the relative importance of the testimony, as do all conclusions in reference to phylogeny.

The general contention in reference to *Welwitschia* is that the two kinds of strobili ("inflorescences") have identical organization; that in the axil of each bract there occurs a flower of the angiosperm type, comprising five cycles of members; that the two innermost cycles form a tetracarpellary closed ovary prolonged into a long style; that the functionally monosporangiate flowers are obviously derived from more primitive bisporangiate flowers; that *Welwitschia* has retained a large number of gymnosperm characters, especially in its "anatomy and histology"; that in evolution such recondite characters change least rapidly, and therefore the phylogenetic position is to be determined by the floral characters, which are essentially angiospermous; that the great reduction of flowers and their aggregation into inflorescences do not suggest angiosperms in general, but rather a very specialized lateral phylum; that the method of specialization resembles that of the *Amentales*, and therefore *Wel-*

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[13] BOT. GAZ. **51**:479. 1911.

[14] LIGNIER, O., et TISON, A., Les Gnétales, leurs fleurs et leur position systématique. Ann. Sci. Nat. Bot. IX. **16**:55–185. *figs. 40.* 1912.